

Binary Mixtures of Ising Fluids

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We study a binary mixture of a van der Waals fluid and a magnetic fluid at zero magnetic field on the basis of the mean field Ising fluid model of Hemmer and Imbro [1] and the van der Waals theory with quadratic mixing rules as described by van Konynenburg and Scott [2]. Depending on three reduced parameters, the phase diagram shows a surface of magnetic phase transitions and lines of tricritical points, critical end points and magnetic consolute points. First order phase transition surfaces and critical lines are calculated numerically. For the line of tricritical points, which can occur in two different topologies, an analytic expression is derived. All higher order lines and coexistence surfaces are visualized in three-dimensional x, T, p - and ξ, T, p -diagrams, where ξ is a mapping of Δ , the conjugated field of the mole fraction x , on the unit interval. Cross-sections of the x, T, p -diagrams at constant pressure are compared to phase diagrams obtained from Monte Carlo calculations (Gibbs Ensemble simulations [3] and cumulant intersection method [4]).

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